

## THE STUDY OF MICROLEPIDOPTERA.

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The *Record* commenced its existence in April 1890, not quite fifty years ago, but in any general, albeit brief, *résumé* of the study of Microlepidoptera it is better to go back some ten years earlier. Up to about 1880 the systematics of the Micros. had followed along much the same lines as in the case of other Lepidoptera, various authors having used external and obvious characters, such as colour, shape of wings, antennae and palpi, as a basis of differentiation of families and genera. Herrich-Schäffer, in the fifties, had realised the value of neuration characters and was followed by Heinemann and Wocke, but, although Stainton illustrated these characters in his book on British Tineina (1854), he made no use of them, nor did Zeller and most other authors of that date. With the general acceptance of the Theory of Evolution, the importance of neuration as indicative of phylogenetic affinities, and not merely as an aid to classification, was recognized by Meyrick first in his work on Australian Microlepidoptera (1879→) and afterwards, as regards the British species, in his *Handbook* (1895). So far as the British species are concerned, this *Handbook* represented the first attempt to arrange them in any natural classification, and it certainly acted as a stimulus to their taxonomic study, although regarded as revolutionary at that time. Meyrick's first scheme of arrangement was gradually modified and improved by further study of European and Exotic forms, as can be seen by comparison of his *Handbook* (1895) and *Revised Handbook* (1928) of the British species. The arrangement of the European species was largely recast by Arnold Spuler, whose book, "Die sogenannten Kleinschmetterlinge Europas" (1903-1910; republished separately 1913), contains no analytic keys, a want which has been supplied by Hering's two volumes in *Die Tierwelt Mitteleuropas* (1932), which include all the Central-European Lepidoptera. The North American Microlepidoptera (or a large proportion of them) have also been rearranged in Forbes' *Lepidoptera of New York* (1924). All these three systems, although mostly based on neuration characters, differ in details, principally in classification of some of the smaller and lower groups, and are not easy to correlate—a difficulty which is not decreased by the different terminology of the venation used by each author. Doubtless each prefers his own, but Herrich-Schäffer's notation is so simple that it is difficult to see what advantage is gained by any alteration: thus, Fw. vein 7 (H.S.) becomes II.5 (Spuler) and R.5 (Forbes: Comstock-Needham).

More recently, the study of the genitalia has been employed by some (*e.g.*, Pierce 1922, 1935, 1938) as a basis of classification; but, although the genitalia are useful for specific differentiation, it seems doubtful whether we know sufficient of this subject to employ it for separation of higher categories; at present, the species, of which the genitalia have been studied, form a very minute proportion of those described—and the species described are only a small fraction of those existing. Larval characters have also been used (Dyar, Chapman, Fracker) and also pupal characters (Chapman, Mosher), but in these cases also the proportion studied is very minute. All such characters must be considered and will doubtless be used to a larger extent as

knowledge increases, but we may be certain of one thing, that no finality in classification will be reached in our time. The thorny subject of Nomenclature has been tackled by Walsingham and Durrant (*E.M.M.*, 1897-1909) and in Fletcher's List of Generic Names (1929).

In a short sketch it is impossible to mention even briefly all the scattered literature published only on the British species in numerous magazines and local lists; in the case of European species this difficulty is increased, and, when we survey the world-wide species, we find many Families (*e.g.*, Scaeosophidae, Anomologidae, Cyclotornidae, Prototheoridae) unfamiliar even by name to European collectors. Only a very scanty selection of publications can, therefore, be mentioned here.

**BRITISH ISLANDS:**—Buckler's Larvae, Volume IX (1899), contains a few odd figures and descriptions; Meyrick's Handbook (1895) and Revised Handbook (1928) include descriptions of all genera and species; Barrett's Lepidoptera, Volumes IX-XI (1903-1907), contain descriptions and figures (often decidedly crude) of the Plumes and Tortricina only, with some useful notes on Life-histories, but the generic diagnoses are valueless verbiage.

**EUROPE:**—Rebel's Catalogue (1901) included all the Palaearctic species then known but is now considerably out of date; Spuler's Schmetterlinge Europas, Volume II (1903-1910), gives short but useful diagnoses, with some figures, of the Central-European species, to which Hering has added keys, as already stated; Rebel's edition of Berge's Schmetterlingsbuch is on much the same lines as Spuler; Hering's recent book on Leaf-miners (1935-1937) must also be mentioned, although not entirely devoted to Microlepidoptera; similarly, the American "Leaf-Mining Insects," by Needham, Frost and Tothill (1928).

**EXOTIC:**—Meyrick's Exotic Microlepidoptera (1912-1937) contains descriptions of new genera and species from all parts of the world.

**N. AMERICA:**—Dyar's List of N. American Lepidoptera (1903) is very useful to that date, with references to Literature; numerous papers have since been published by Busck, Kearfott, Miss Braun, Dietz, Lord Walsingham, McDunnough, Keifer, and others; Forbes' Lepidoptera of New York has already been mentioned.

**CENTRAL AMERICA:**—Lord Walsingham's volume in the Biologia Centrali-Americana, Heterocera, Vol. IV (1909-1915), is an outstanding work; Mr Busck has also described many new forms from Panama.

**WEST INDIES:**—The Microlepidoptera were dealt with by Lord Walsingham in P.Z.S. 1891 (1892) and 1897 and by Forbes (1930, 1931).

**SOUTH AMERICA:**—Meyrick has described many new forms in T.E.S. 1911 (1912), 1913, 1914, 1917 and 1922, and also in other papers.

**AFRICA:**—Lord Walsingham (T.E.S. 1881) dealt with S. African species and in 1891 and 1897 with W. African forms, in P.Z.S. 1896 with species from Aden and Somaliland, and in P.Z.S. 1907 (1908) with the Micros. of Tenerife; African species, mostly from S. Africa, were also described by Meyrick in P.Z.S. 1908 and subsequently in papers in the Annals of the S. African, Transvaal and Natal Museums and in Voyage Alluaud Afrique Orient. (1920) and in several shorter papers; Meyrick has also described Microlepidoptera from Abyssinia and Egypt, Count Turati many from Cyrenaica, whilst Lord Walsingham dealt with Moorish and Algerian Micros. in *E.M.M.* (1901-1911) and Zerny has recently (1935) listed species from Morocco; Professor Rebel's eight papers on the Lepidoptera of the Canary Islands (1892-1938) must also be mentioned.

**ASIA:**—Snellen (1884),

Filipjev and other Russian authors have described species from North Asia; Lord Walsingham described Asiatic Tortricina (*A.M.N.H.* 1900); the Micros. of the Indian Region were described by Meyrick in the *Bombay Journal* (1905-1914) and their life-histories by Fletcher (1921, 1932, 1933); some forms from Java and Sumatra were dealt with by Snellen and van Deventer and also by Meyrick (1921, 1922, 1925); species from Tonkin were listed by de Joannis (1931: descriptions by Meyrick); the Chinese fauna has provided several papers by Prince Aristide Caradja (descriptions by Meyrick); and a few species from Formosa were dealt with by Meyrick (1914) and from Borneo (1926), and Japanese forms have been described and figured in Matsumura's 6000 Illustrated Insects (1931) and in Esaki's *Nippon Konchu Zukan* (1932); the Micros. of the Islands in the Indian Ocean were also dealt with by Meyrick (1902, 1910, 1911, 1924 and 1930) and Fletcher (1910).

**AUSTRALIA AND NEW ZEALAND:**—Meyrick's numerous papers (1879-1938) form the foundation of all future work and very many new genera and species have been described by Lucas, Turner and other local workers; Hudson's *Butterflies and Moths of New Zealand* (1928) gave descriptions and coloured figures of all forms then known and a supplementary volume will be issued shortly; Philpott also wrote largely on New Zealand species; Tillyard's *Insects of Australia and New Zealand* (1926) gave a general account, with some figures; there is also a considerable literature on economic species in agricultural publications, as is the case in all other areas; the Australian Oecophoridae, which alone number as many species as the whole of the British Lepidoptera, are now being revised by Dr A. Jefferis Turner in a series of papers in *P. Linn. Soc. N.S.W.*; Durrant (1915) published a short paper on a few species from New Guinea and a collection by Miss Cheesman was worked out by Meyrick in 1937, in a paper not yet published.

**OCEANIA:**—The outstanding work is the contribution by Lord Walsingham to the *Fauna Hawaiiensis* (1907), but many new species and life-histories have since been added by Swezey and other local workers; Meyrick's work also includes papers on Juan Fernandez and Easter Island (1922), Samoa (1927), S. Pacific (1929), Society Islands (1934).

Turning to papers on special groups, once again only a few can be mentioned. The Plumes have produced a large outcrop of literature:—Walsingham's Pterophoridae of California and Oregon (1880), Fernald's N. American Pterophoridae (rev. edn., 1898), again revised by Barnes and Lindsey (1921), Hofmann's *Die deutschen Pterophorinen* (1896) and palaeartic Orneodidae (1898), Tutt's Monograph of the British species (1890-1895) with his *Brit. Lep.*, Vol. V (1907), new species by Meyrick in *T.E.S.* 1907 (1908), Fletcher's Plumes of Ceylon (1909, 1910) and of Seychelles (1910) and Revision of *Deutero copus* (1910), Meyrick's Pterophoridae and Orneodidae (Wytsman 1910) and Catalogue (1913), Wahlgren's Swedish Plumes (1915) and Fletcher's Catalogue of the Indian Alucitidae (1931). Papers on the Tortricina include Fernald's *Genera and Types* (1908), papers by Kearfott on N. American species, Heinrich's Revision of N. American Eucosmidae (1923, 1926, 1929), Meyrick's revision of the Australian and New Zealand species (1910, 1911) and his Catalogue of the Tortricidae (1912) and revision (Wytsman 1913), and Kennel's *Die palaearktischen Tortriciden* (1908-1921). In Gelechiadae Meyrick's revision in Wytsman

(1926) and Gaede's Catalogue (1937) are the most important; Benander's paper on the Swedish species (1928) also deserves mention here. In Oecophoridae, Meyrick's revision (Wytsman 1922); Turner's present revision of the Australian species has already been referred to. In Aegeriadae, Beutenmuller's Monograph of the Sesiidae of N. America (1901), the Catalogue by Dalla Torre and Strand (1925), Le Cerf's important contributions in Oberthür's *Et. Lep. comp.* and other publications, Hampson's revision of the African and Oriental species, and the articles in Seitz' *Macrolepidoptera*. Revisions in Wytsman's *Genera Insectorum* and Catalogues of the Families have also been published by Meyrick for the Carposinidae, Heliodinidae, Glyphipterygidae, Gracilariidae, Adelidae and Micropterygidae, and Catalogues only of the Yponomeutidae, Plutellidae and Amphitheridae. Wagner and Pfitzner have also issued a Catalogue of the Hepialidae (1914) (also articles in Seitz), and Tutt (*Brit. Lep. I: 1899*) gave a detailed account of the British Stigmellidae (Nepticulidae).

The above brief and necessarily very incomplete account may serve to show that active progress in Microlepidopterozoology has taken place during the last half-century. Even in the best-worked countries, however, new species still turn up and many life-histories and other details remain to be elucidated; in the remainder of the world, however, the greater part of its Microlepidopterous fauna is still to be discovered.

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### SOME CHANGES IN OUR OUTLOOK ON VARIATION.

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It is impossible in a few pages to review the great progress made in Entomology in the last fifty years. No more can be attempted than to show how the advances in knowledge have changed our outlook on some of the problems that interested our founder. Of the period when this journal was started Bateson was able to write with truth "the terms 'variation' and 'heredity' stood for processes so vague and indefinite that no analytical investigation of them could be contemplated." The way to a more precise understanding of variation and heredity and of the nature of species and subspecies was not opened until Mendel's paper was rediscovered in 1900. Proof that segregation of characters occurred in animals as well as in plants soon followed and it was shown that many mutant forms were determined by a single gene and were either dominant or recessive to the normal form. The phenomenon of reversion, so puzzling to Darwin, was explained, for forms that reverted to the normal were recessive. They were not lost, but were rendered latent, and if members of the  $F_1$  generation were crossed *inter se* they reappeared in the ratio 1:3. Many rare aberrations of butterflies and moths regarded by contributors to our early numbers as meaningless sports or freaks are no doubt rare recessives, though in most cases proof of this is still lacking.

As time went on it was shown that, though the obvious effect of a gene might be only a striking alteration in colour or pattern, it had subtle but far-reaching effects on the constitution of the whole organism. It was also found that in a mutant form determined by a single gene considerable variation occurred and that this was due to the modifying